CS1010 Programming Methodology

http://www.comp.nus.edu.sg/~cs1010/

UNIT 2

CS1010 Computing Environment

Unit 2: CS1010 Computing Environment

1. Types of Programs
2. Program Development
3. Programming Environment
4. sunfire – a UNIX machine
5. vim – a text editor
6. File transfer

Types of Programs

- Machine code

Program to which computer can respond directly. Each instruction is a binary code that corresponds to a native instruction.

Eg: 0001001101101110

- Assembly code

Requires translation

- High-level language program

Low-level language with strong (generally one-to-one) correspondence between assembly code and machine code instructions.

Eg: MIPS (add t1, t2, t3)

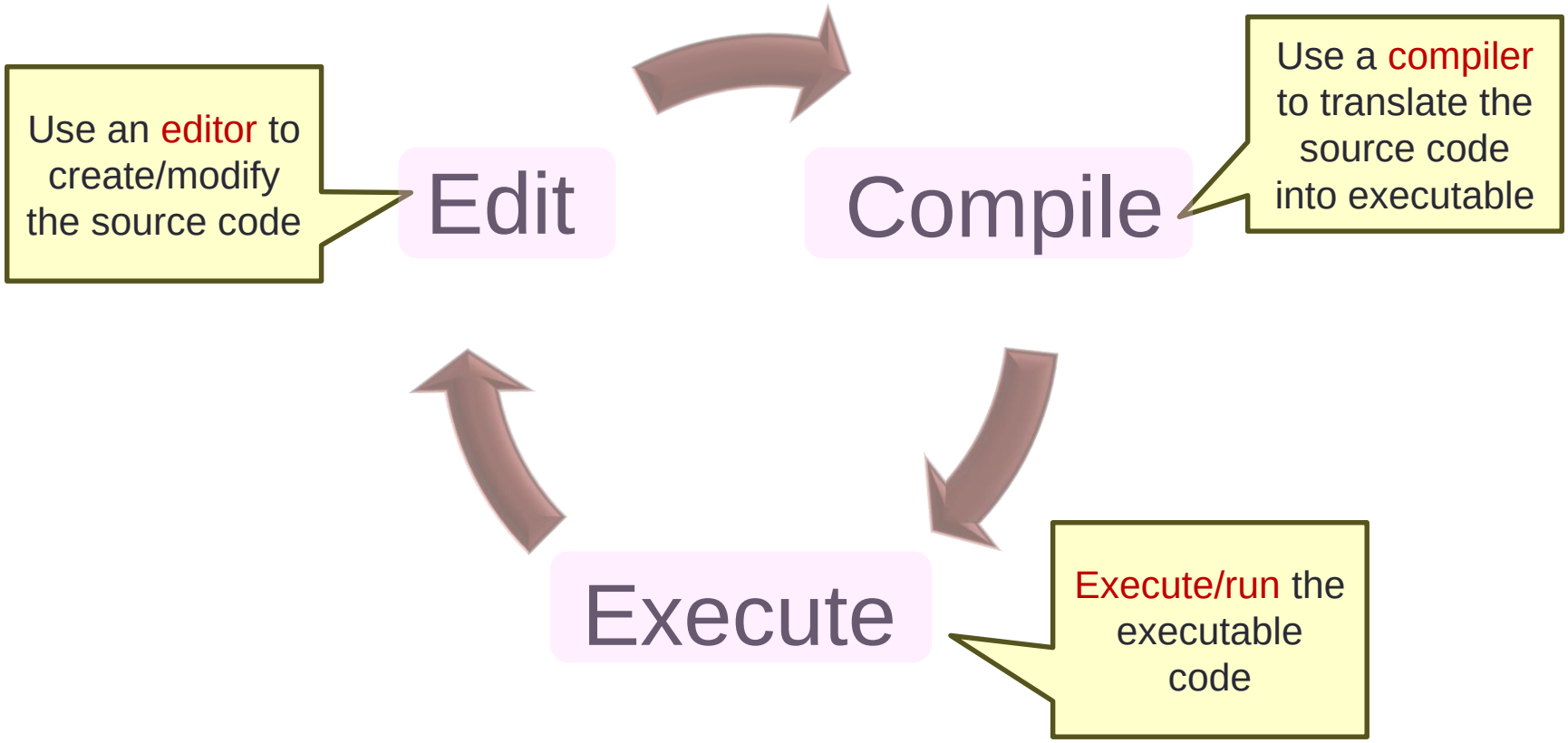
Detailed knowledge of the machine is not required. High level of abstraction. Ease of writing and understanding.

Eg: Java, C, C++, Python.

Translation of Programs

- High-level language programs (eg: C) cannot be executed directly by the computer
- Require a translation process called compilation
- A special program called compiler is used
- The original C program is called the source code
- The compiled program is the executable code or machine code
- In general, executable codes generated on a certain machine cannot be executed on another machine with a different architecture
  - The source code needs to be compiled on the new machine

The Edit, Compile and Execute Cycle



Process is iterative

COMPUTER ENVIRONMENT

Romance of the Three Kingdoms

Romance of the Three Kingdoms

CS1010 Programming Environment (1/2)

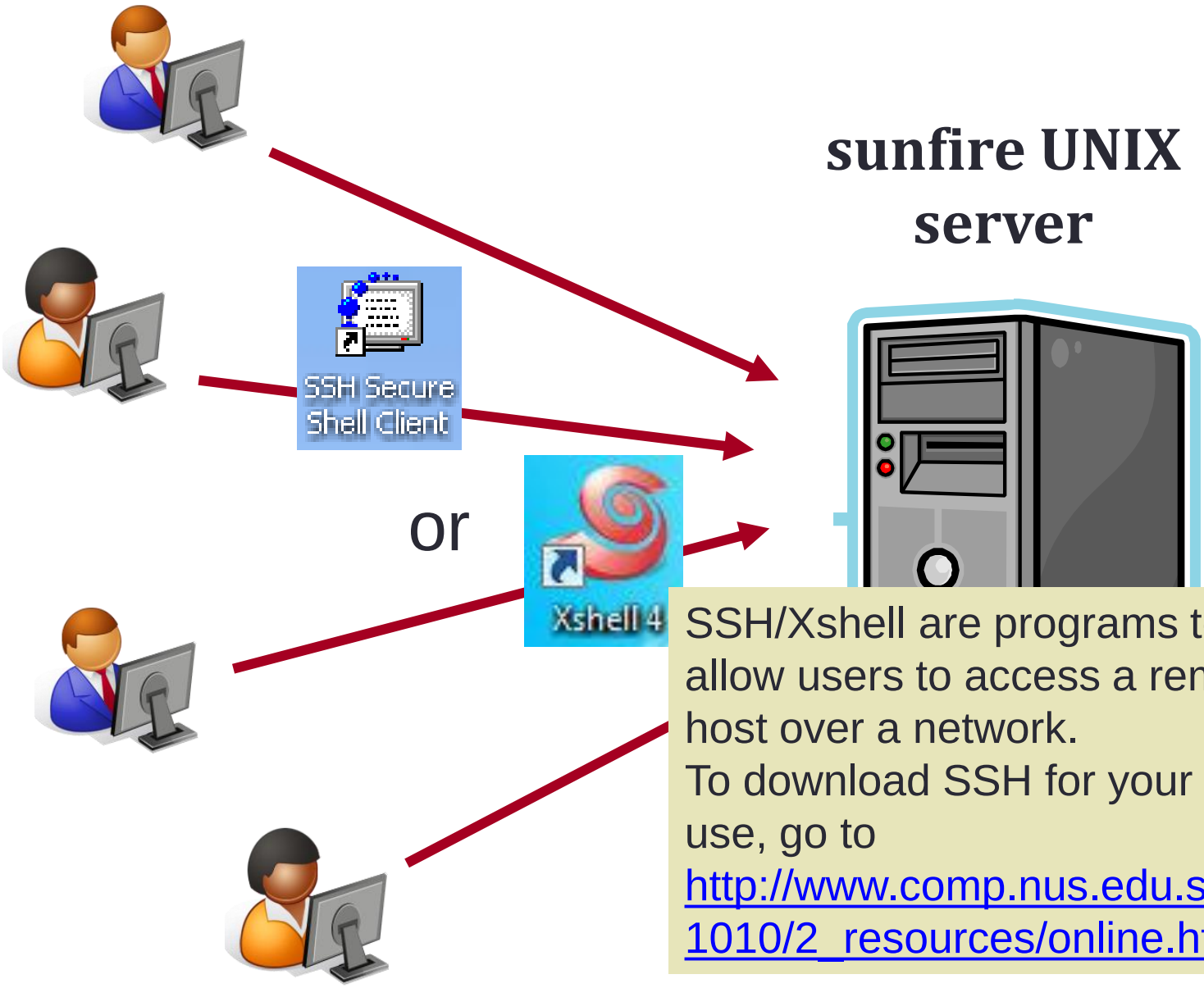
- UNIX system – the sunfire server
- Every SoC student or student taking an SoC programming module can apply for a UNIX account
- To login to sunfire server, you need your SoC UNIX account user-name and password.
- If you don't have a UNIX account yet, go to this link to create one (same link if you have forgotten your UNIX password):

  https://mysoc.nus.edu.sg/~newacct

CS1010 Programming Environment (2/2)

- You can do many things with your sunfire account:
  - Eg: Your account comes with paper quota
    - see https://docs.comp.nus.edu.sg/node/1732 for your print quota allocation
  - Some treat their sunfire account as a backup harddisk
  - Refer to SoC Computing Facilities web page for more general information

    https://docs.comp.nus.edu.sg/cf/



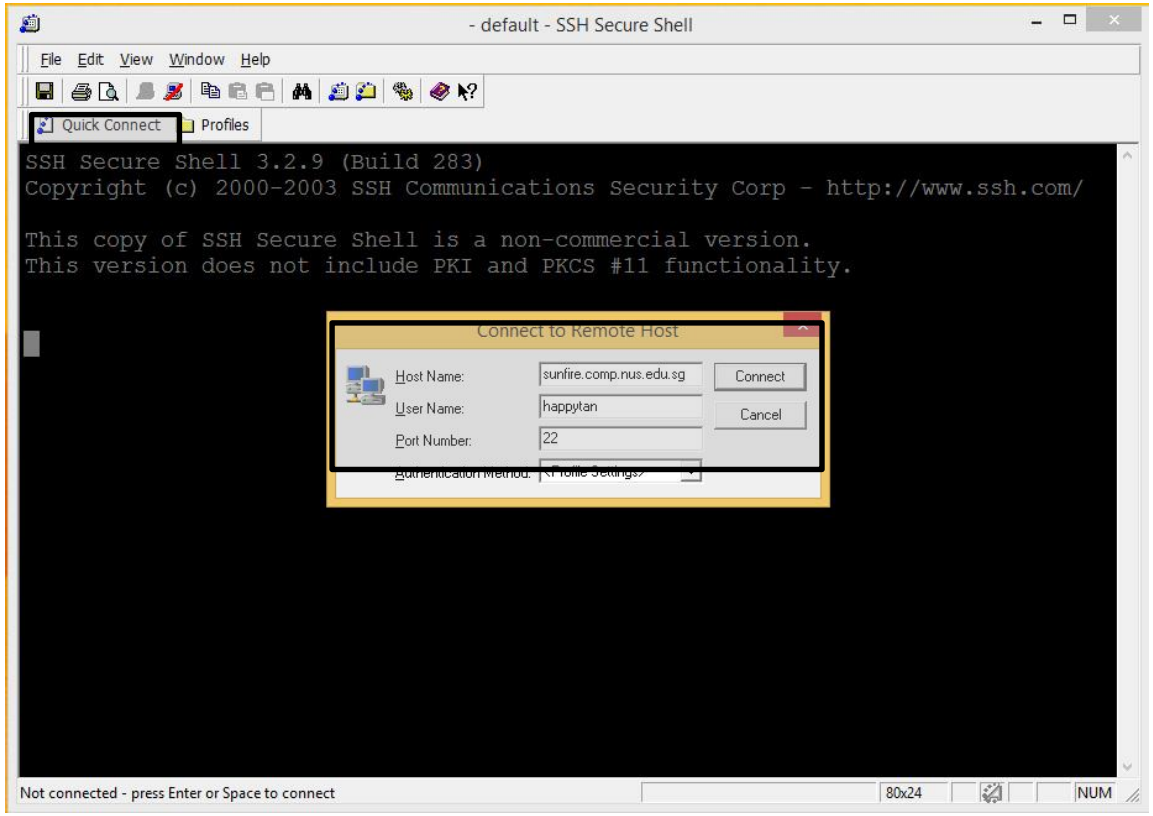
SSH/Xshell are programs to allow users to access a remote host over a network.
To download SSH for your home use, go to http://www.comp.nus.edu.sg/~cs1010/2_resources/online.html

Logging into sunfire (1/2)

1. Look for the SSH Secure Shell Client icon or Xshell icon on your desktop, and double click on it. We shall assume you are using the former here.

or

2. Click on "Quick Connect" to get the pop-up window.



   Enter "sunfire" for Host Name if connecting within campus or "sunfire.comp.nus.edu.sg" if connecting from off campus

   Enter your UNIX id as User Name.

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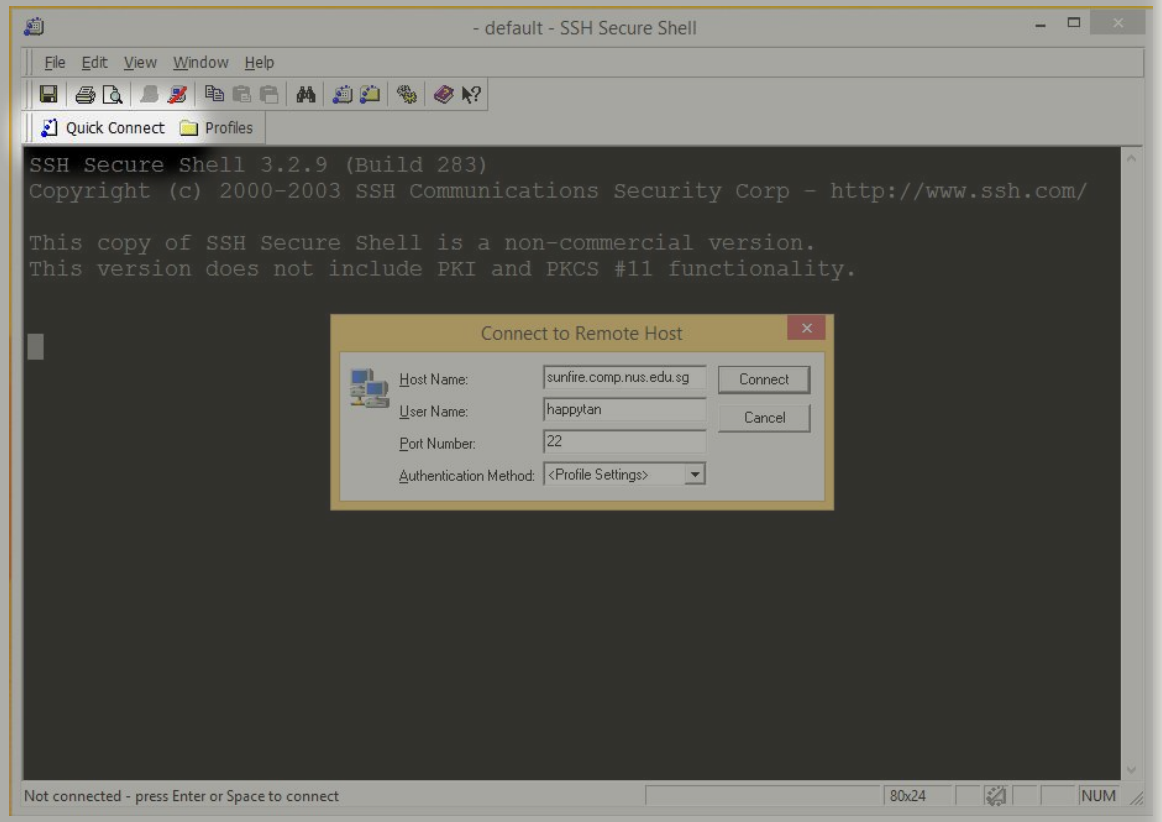

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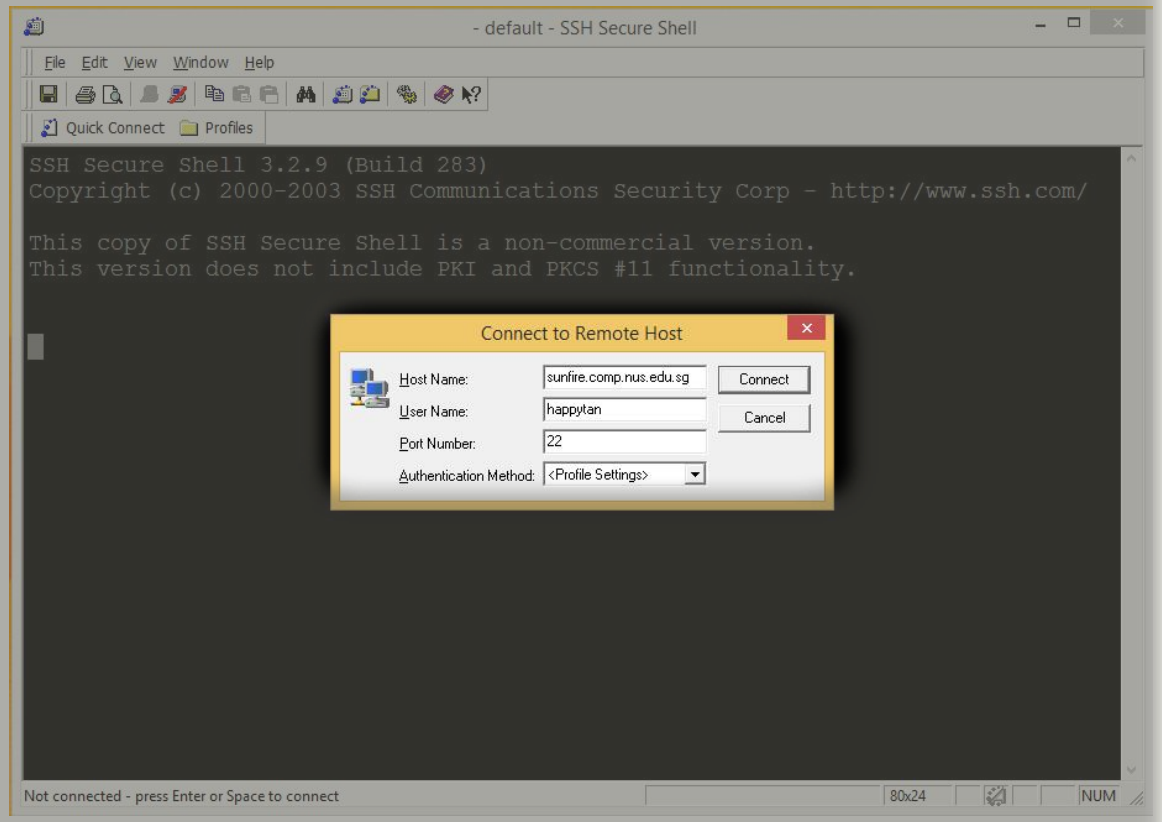
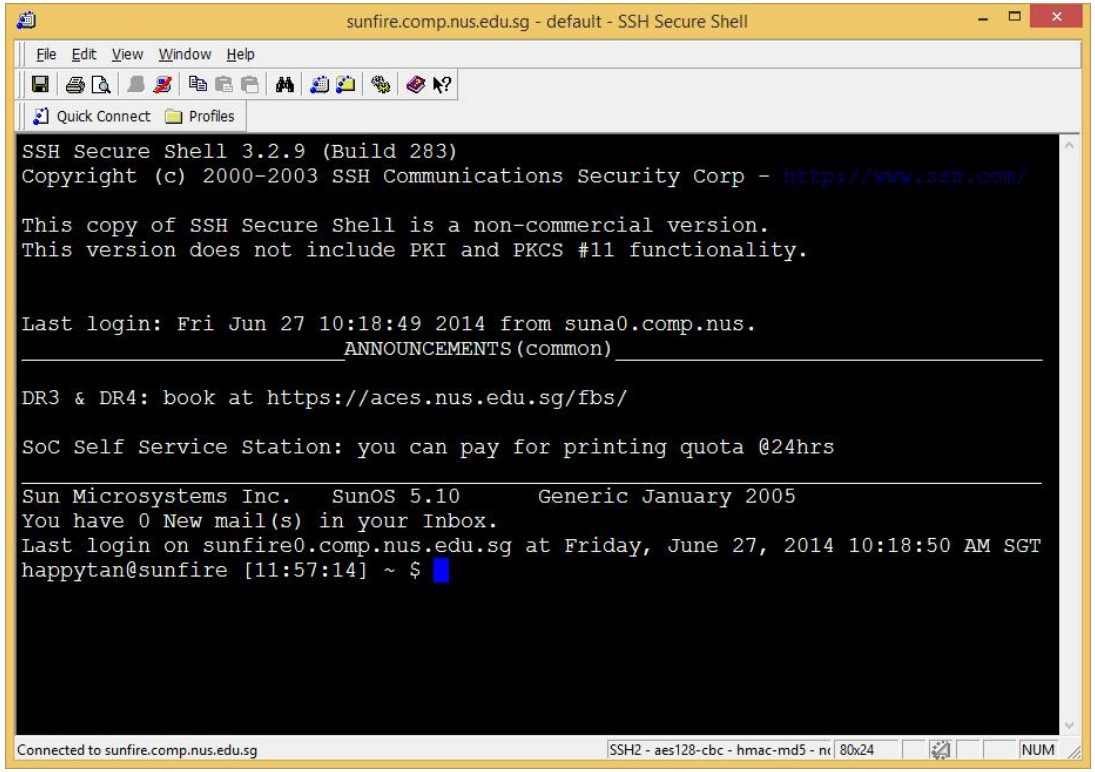


Logging into sunfire (2/2)

3. Enter your UNIX password.

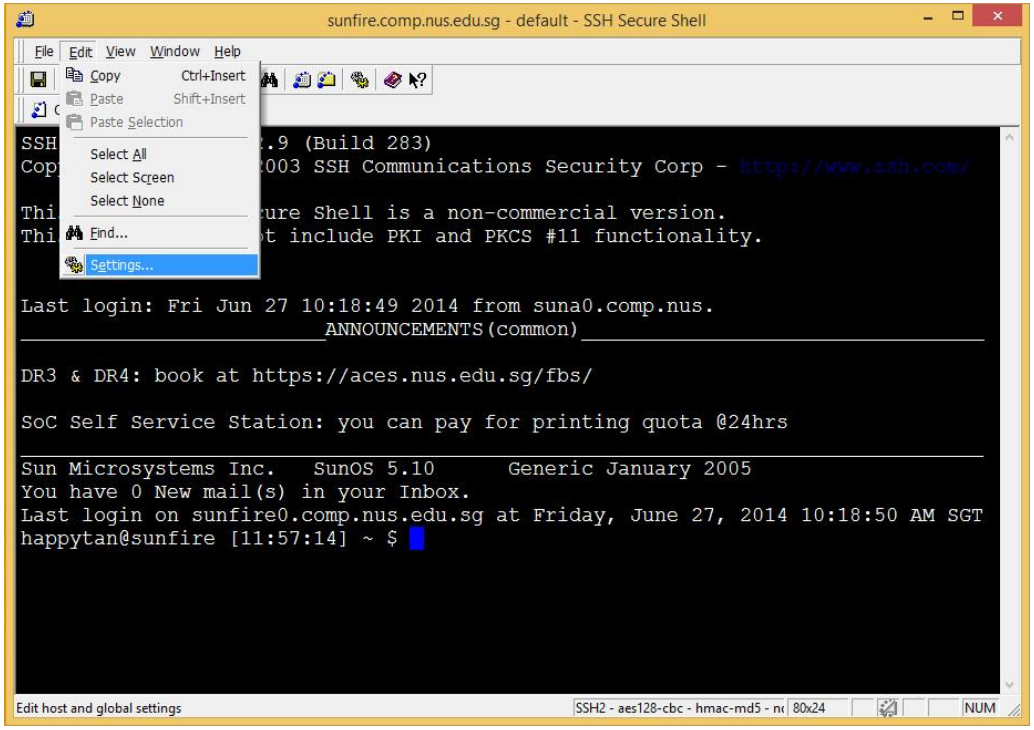
4. Once you log in successfully, you will see this screen (actual display may vary).

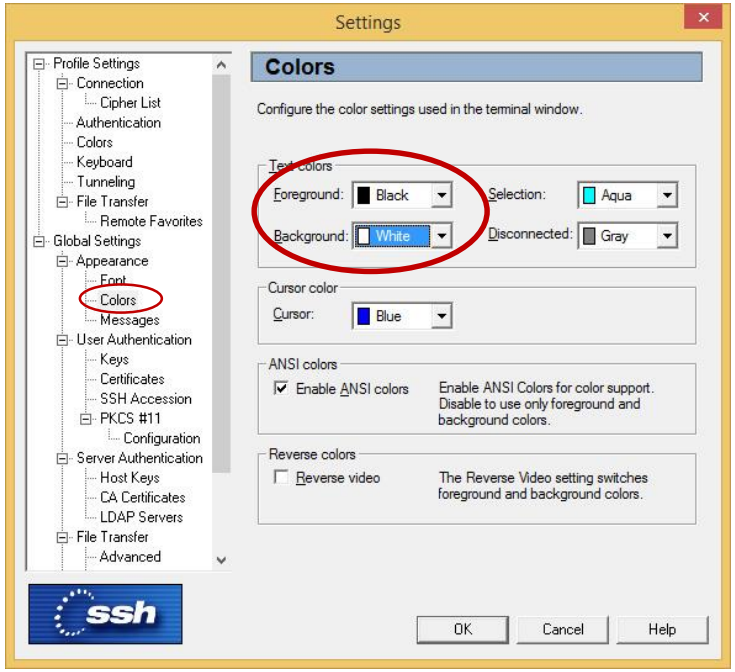


5. To log out from your UNIX account, type "exit" or "logout".

Change settings in SSH

- You may change the settings in SSH (eg: font size, background colour, text colour, etc.)
- For example, to change background and text colours, click on "Edit" → "Settings" and change the desired settings accordingly.





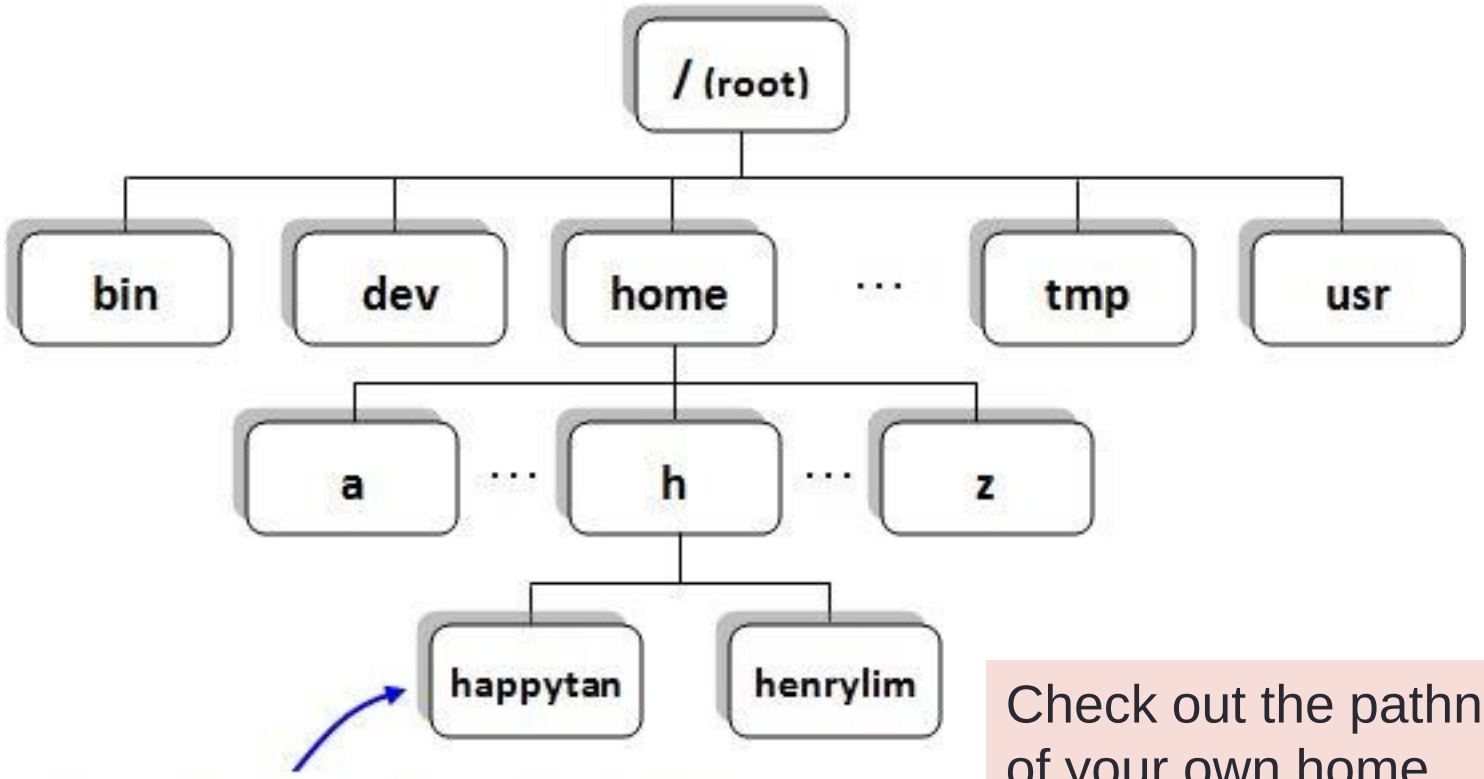

password

Trying out some UNIX commands

- Type ‘ls’ (list) to list out the files in your directory
- You see no list because your account is brand new. There are no files in there.
- Type ‘pwd’ (print working directory) to show the pathname of your current directory
  - An example output: **/root/home/h/happytan**

ls and pwd are just two UNIX commands.
UNIX commands are case-sensitive.

File Directories in sunfire (1/2)



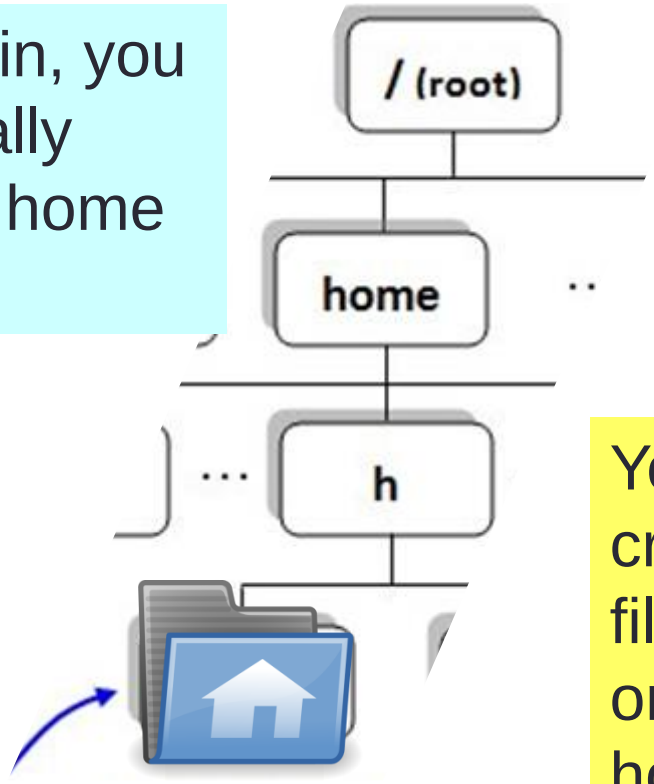
Home directory of user happytan.

/home/h/happytan

Check out the pathname of your own home directory by typing 'pwd'

File Directories in sunfire (2/2)

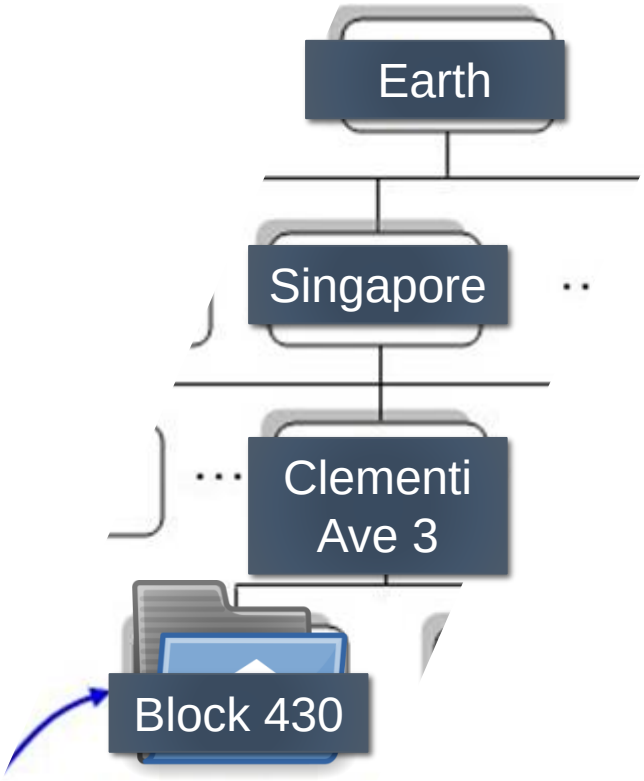
When you log in, you are automatically placed in your home directory.



You are allowed to create/modify/remove files or subdirectories only under your home directory.

```
/root/home/h/happytan
```

File Directories in sunfire (2/2)




```
/root/home/h/happytan
```

Setting up your UNIX account

- As your new account is currently bare, run the following set-up to configure your account:

  1. **`~cs1010/workshop/setup`**

     (enter **y** when prompted)

  2. **`source .bashrc`**

     (no response from the system is good news!)

You need to do this only ONCE.

- (1) does the following in your home directory
  - Creates a 'c' subdirectory and puts a few C programs into the 'c' subdirectory
  - Copies a number of system files into the home directory, including **.vimrc** (vim configuration file)

Basic UNIX Commands (1/4)

- In UNIX, typically you do a lot of typing but much less mouse clicking, compared with other operating systems like Windows
- UNIX commands are case sensitive
- Practice is the best way to recognize UNIX commands. Gradually you will be more and more familiar with UNIX commands – so don't worry too much at the beginning
- In sunfire, you can use the up ↑ and down ↓ arrows to select (and optionally modify) a previous command in the command log

Basic UNIX Commands (2/4)

- Following the “Getting Started with UNIX and CodeCrunch” document

  (http://www.comp.nus.edu.sg/~cs1010/labs/2016s1/intro_lab/gettingStarted.html), your lecturer will go through these basic UNIX commands with you in class. (We will introduce CodeCrunch in the next lesson.)

Directory command	Description
pwd	Print Working Directory
ls	LiSt files in current directory
cd	Change Directory
mkdir	MaKe a subDIRectory
rmdir	ReMove an empty subDIRectory

File command	Description
cp	CoPy file
mv	MoVe file, also to rename file
rm	ReMove file
cat	CATenate file (to view a file)

Basic UNIX Commands (3/4)

- Command options
  - Many UNIX commands come with options, preceded by '-'

```
happytan@sunfire [] ~ $ ls
c
```

The plain ls command

```
happytan@sunfire [] ~ $ ls -F
/c
```

-F prefixes directory name with /

```
happytan@sunfire [] ~ $ ls -l
drwx------    2 happytan soc06   4096  Jun 27 12:58 c
```

-l displays info in long format

```
happytan@sunfire [] ~ $ ls -a
.    ..    .bashrc   .vimrc     c
```

-a displays hidden files (files beginning with '.' in their names)

```
happytan@sunfire [] ~ $ ls -al
drwx------    3 happytan soc06   4096  Jun 30 08:45 .
drwxr-xr-x  215 happytan root    8192  Jun 13 12:58 ..
-rwx------    1 happytan soc06    434  Jun 27 12:45 .bashrc
-rwx------    1 happytan soc06    237  Jun 27 12:45 .vimrc
drwx------    2 happytan soc06   4096  Jun 27 12:58 c
```

Options may be combined: `ls -al` or `ls -a -l`

Basic UNIX Commands (4/4)

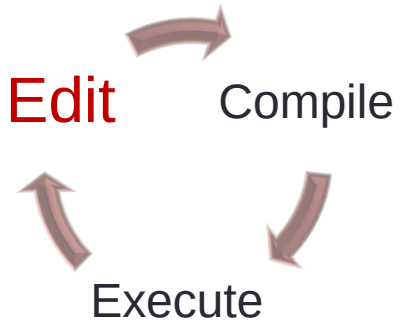
- Help using man command ('man' stands for 'manual')
  - Type man *command* to find out more about a certain command
  - Eg: man ls
  - Press <spacebar> to read next screen, or enter 'q' to quit.

- Filename auto-filling
  - Provides auto-filling of filenames, handy for very long filenames
  - Press <tab> for system to fill out the rest of the filename (as much as it can)

```
happytan@sunfire [] ~ $ cd c
happytan@sunfire [] ~/c $ ls
example1.c   example2.c   example3.c
happytan@sunfire [] ~/c $ cat e ← press <spacebar> after typing 'e' and observe
```

System managed to fill filename up to 'example' and stopped, because there are 3 filenames that begin with 'example'. Type '1', '2', or '3' and press <tab> for system to fill the whole filename, then press <enter>.

Editing C source codes (1/3)



- We use a text editor to create/modify C programs (source codes)
- We will use the vim editor

- vim is a powerful text editor. It has 2 modes
  - Command mode: for issuing vim commands
  - Insert mode: for typing in text
- To switch between command mode and insert mode
  - Type i in command mode to get into insert mode
  - Press <esc> key in insert mode to get into command mode

Vim is like….

- Chopper!!
  - With different **modes!**

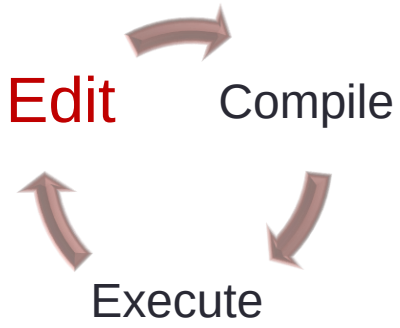
Vim is confusing at first

How do you generate a random string?
Put a web designer in front of VIM
and tell him to save and exit.

Vim Quotes

- “I fell in love the way you fall asleep: slowly, and then all at once.” – The Fault in Our Stars
- In Chinese:
  - “慢慢來 比較快”
- I will guarantee that typing in vim is faster then using a mouse for code

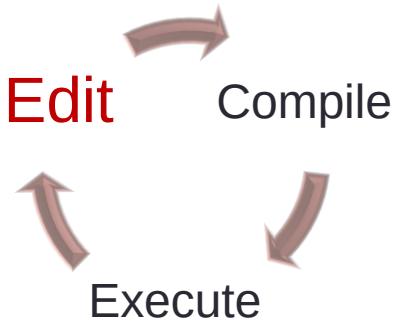
Editing C source codes (2/3)



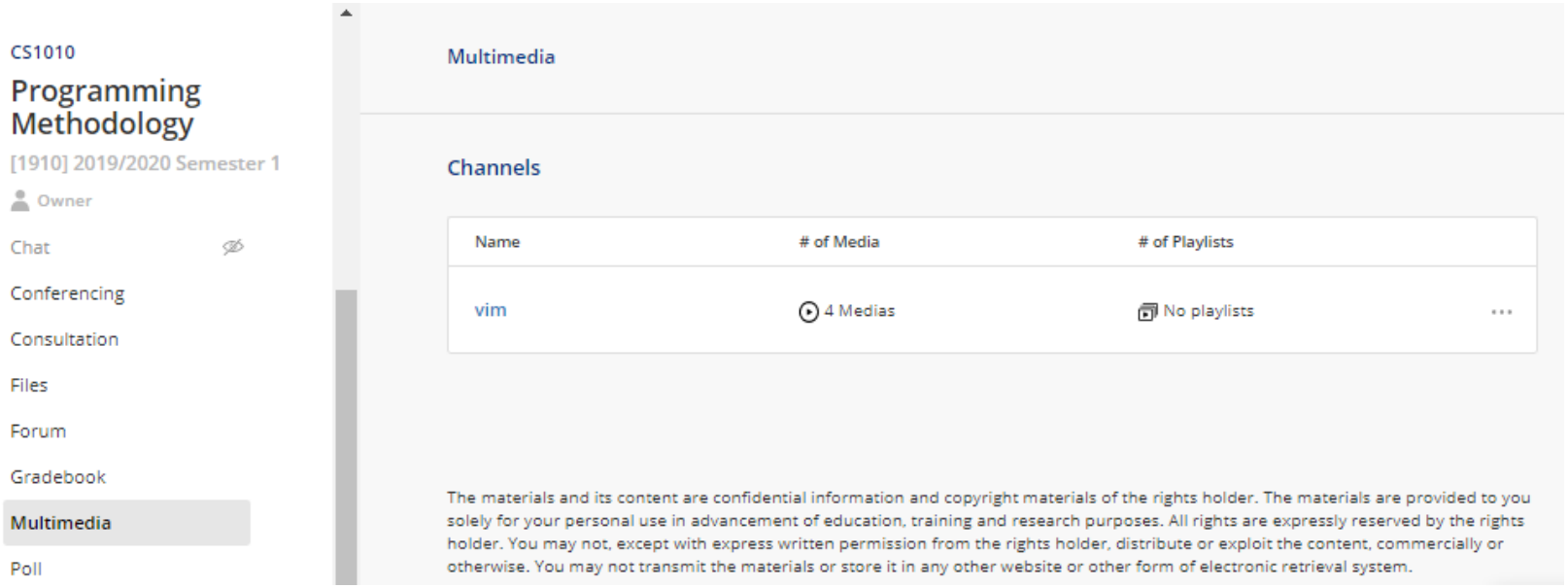
- Use vim to create this C program first.c

```c
#include <stdio.h>

int main(void) {
   int a=27, b=6, c;

   c = a%b;
   printf("The value of c is %d.\n", c);

   return 0;
}
```

Editing C source codes (3/3)

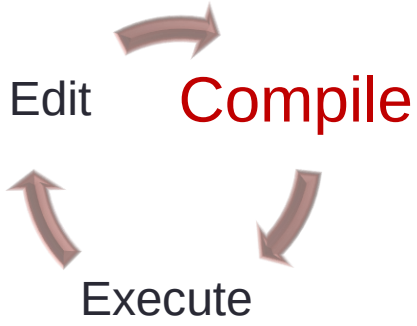


- 4 videos on vim are available on IVLE
  - Luminus → CS1010 → Multimedia → vim



- CS1010 “Online” page:
  http://www.comp.nus.edu.sg/~cs1010/2_resources/online.html
- Search the Internet

Compiling C programs (1/3)



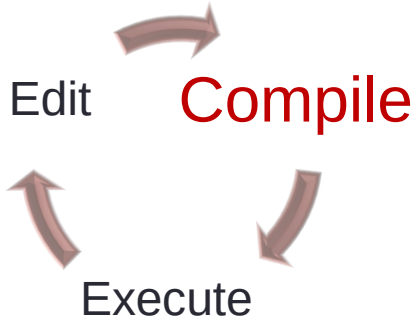
- We use the C compiler gcc in sunfire

- Advisable to add the option –Wall (warnings all) for beginners:

```
gcc -Wall first.c
```

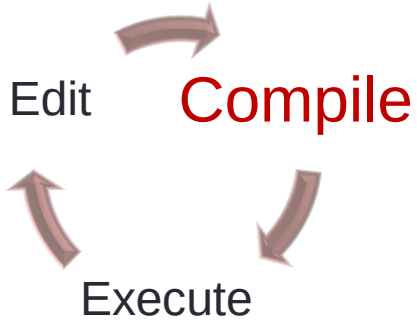
- If there are compilation errors/warnings, you need to edit the source code first.c again (vim first.c), and re-compile (gcc –Wall first.c), until your code is clear of compilation errors/warnings.
- Remember to add option '-lm' if your C program uses math functions
  - Example: `gcc -Wall -lm example1.c`
- Type 'ls' to check that you have the executable code a.out

Compiling C programs (2/3)



- The executable file has the default name a.out. However, all filenames in a directory must be unique, hence there can only be one a.out in a directory.
- Since you have many C source codes in a directory (eg: example1.c, example2.c, example3.c), you might want to have their corresponding executable files all in the same directory, appropriately named.
- Two approaches:
  1. Rename a.out after compilation
  2. Indicate the desired name of the executable file during compilation

Compiling C programs (3/3)



1. Rename a.out after compilation

```
happytan@sunfire [] ~/c $ gcc -Wall -lm example1.c
happytan@sunfire [] ~/c $ mv a.out example1
happytan@sunfire [] ~/c $ gcc -Wall example2.c
happytan@sunfire [] ~/c $ mv a.out example2
happytan@sunfire [] ~/c $ gcc -Wall example3.c
happytan@sunfire [] ~/c $ mv a.out example3
```

Executable files are named example1, example2, example3.

2. Indicate the desired name of the executable file during compilation using the '-o' option

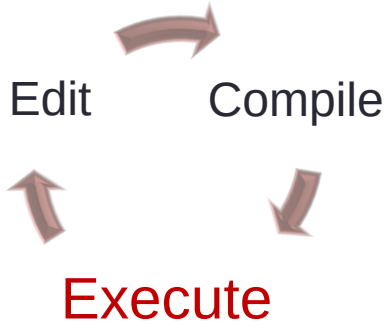
```
happytan@sunfire [] ~/c $ gcc -Wall -lm example1.c -o example1
happytan@sunfire [] ~/c $ gcc -Wall example2.c -o example2
happytan@sunfire [] ~/c $ gcc -Wall example3.c -o example3
```

Be careful not to overwrite the source code accidentally!
The following will replace the source code with the executable file, which is called example1.c now! The source code cannot be recovered!

WRONG WAY

```
happytan@sunfire [] ~/c $ gcc -Wall -lm example1.c -o example1.c
```

Executing C programs

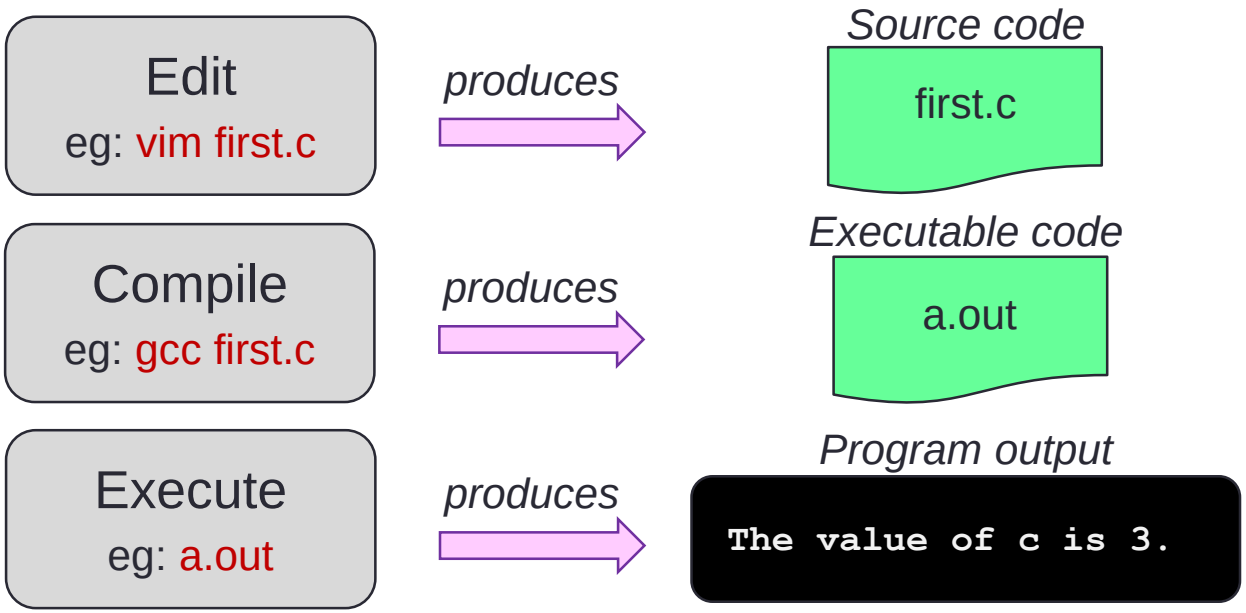


- Executing a C program is simple – just type the name of the executable file

To run the executable file example1:

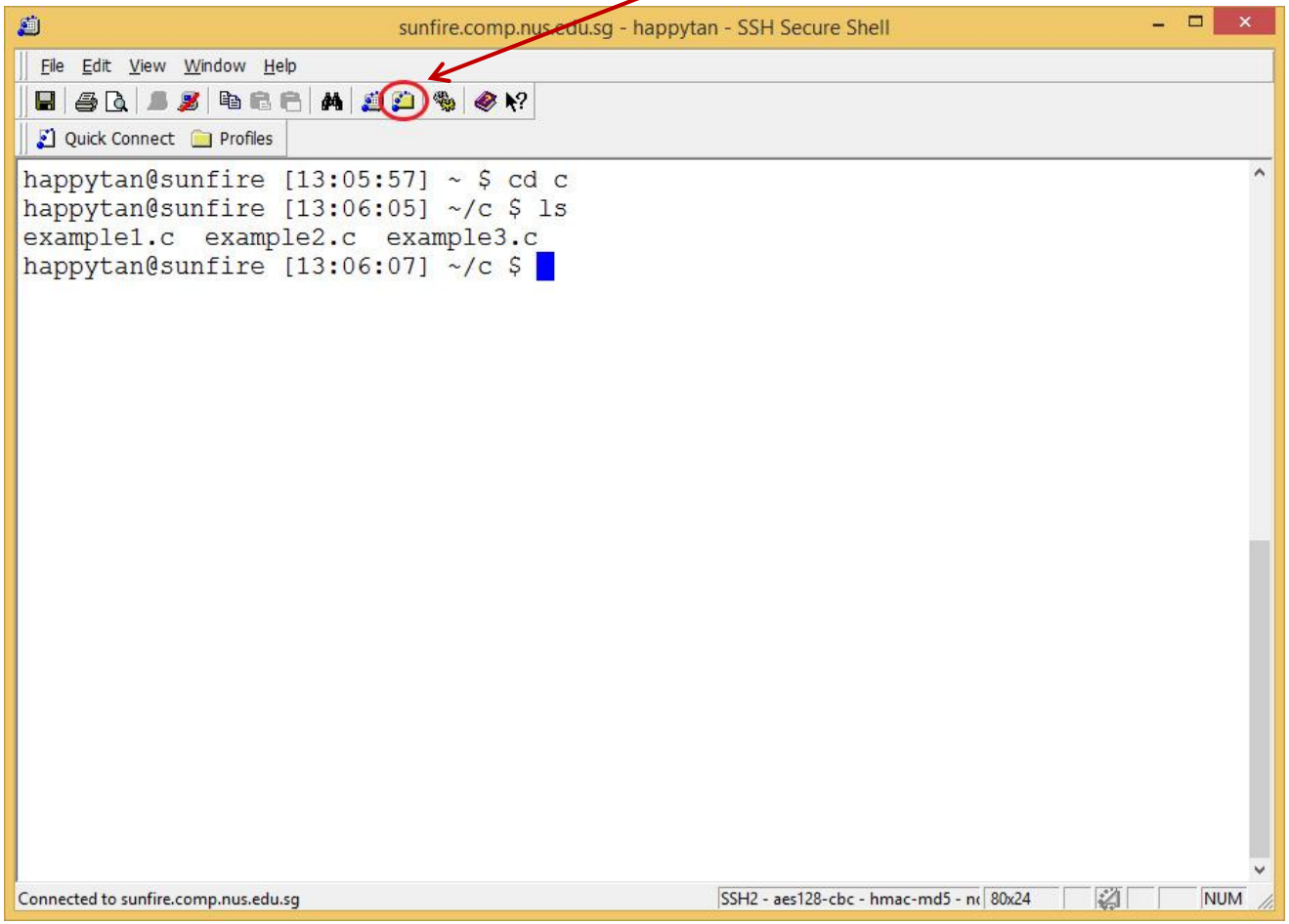
```
happytan@sunfire [] ~/c $ example1
The distance between the 2 points is  3.61
```

- We have gone through the Edit – Compile – Execute process

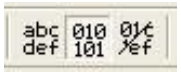


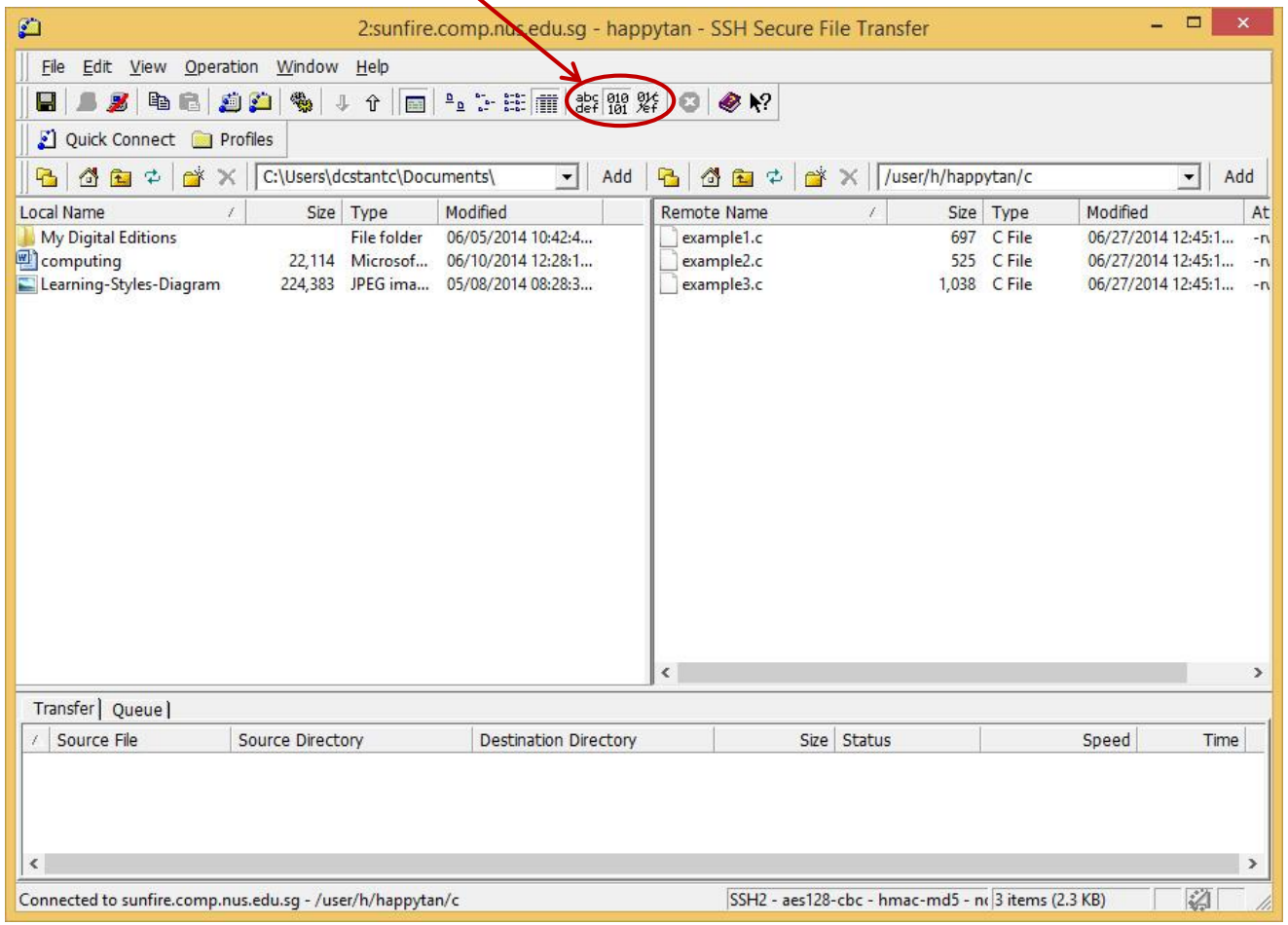
File Transfer (1/2)

- To transfer files between your sunfire account and your local computer, click on the SSH Secure File Transfer icon



File Transfer (2/2)

- Left: your local machine; right: sunfire
- Choose the format: ASCII, Binary or Auto 
- Click on file(s) to transfer, and drag to the destination

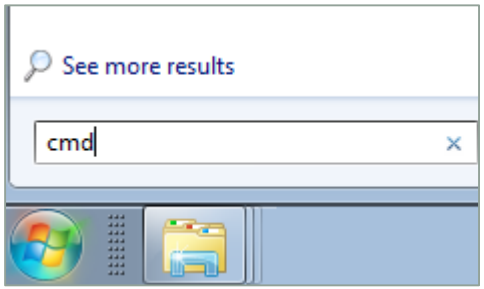


Using Samba Service (1/3)

- Samba service allows you to access your sunfire account directory on Windows when you are connected to the SoC network (directly or via VPN).

- Enable this service at the following URL
  https://mysoc.nus.edu.sg/~myacct/services.cgi

- Open a command prompt on Windows
  - Click on the Start button
  - Type “cmd” in the search box, and press Enter



Using Samba Service (2/3)

- Type in the following command

  net use <drive> \\stusambahost\<UNIX id>

  - Replace <drive> with a drive letter of your choice
  - Replace <UNIX id> with your UNIX id
  - Example: net use Z: \\stusambahost\happytan
  - Login with your NUSNET account when prompted
    - Username: nusstu\<NUSNET id>
    - Password: <NUSNET password>
  - You will be able to access your sunfire account directory through the specified drive letter in Windows

Using Samba Service (3/3)

- If you are using your own PC,
  - Turn on SoCVPN @ https://webvpn.comp.nus.edu.sg using a non-Chrome browser (e.g., Firefox)
  - Use stusambahost.comp.nus.edu.sg in the net use command (instead of just stusambahost)

- For a detailed user guide on Samba service, visit https://docs.comp.nus.edu.sg/node/1663

Summary

- In this unit, you have
  - Familiarised yourself with the programming environment
  - Accessed the sunfire system and learned some basic UNIX commands
  - Used the editor vim to create/modify your C programs
  - Used the compiler gcc to compile your C programs
  - Familiarised yourself with the edit – compile – execute process

End of File